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ABSTRACT

This paper focuses on the refinement and articulation of the invitational education concept to science teaching in the classroom, an approach consistent with the underlying philosophy of SCIS. The first section of the paper outlines the nature of invitations and disinvitations and describes the ability of teachers to send formal or informal messages, verbally or non-verbally, in a school setting. Part two deals with the invitational concept in the science classroom from the teacher's frame of reference, and possible concerns that characterize the professional growth of teachers and influence student perceptions of science. Relationships in science teaching, which may exist between levels of invitational teaching and stages of teacher growth, are discussed. The final part of the paper addresses invitational sciencing through the development of pertinent skills possessed by the inviting science teacher. (Author/CS)

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S.C.I.S. - SCIENCING CONSIDERED FROM AN INVITATIONAL STANCE

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S.C.I.S. - Sciencing Considered From An Invitational Stance

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This paper explores a number of ramifications embodied in the plan of action termed 'invitational education' (Purkey, 1978) from a science educator's point of view. While primarily directed toward pre-service science educators, the concept of invitational teaching is also viewed as a viable process for in-service science education through the application of the concept to postulated stages in the professional development of teachers. The primary focus of the paper, however, is the refinement and articulation of the invitational concept to science teaching in the classroom.

The first section of the paper outlines the nature of invitations and disinvitations and describes the ability of teachers to send messages, formally or informally, verbally or non-verbally in a school setting. Part two deals with the invitational concept in the science classroom from the teacher's frame of reference, and possible concerns that characterize the professional growth of teachers and influence student perceptions of science. Relationships in science teaching, which may exist between levels of invitational teaching and stages of teacher growth, are discussed.

The final part of the paper addresses invitational sciencing through the development of pertinent skills possessed by the inviting science teacher.

In exploring the model of invitational education from a science educator's perspective, I have been encouraged (perhaps discouraged is more accurate) by what I sense to be an unhealthy attitude toward science and science teaching held by a surprisingly high number of pre-service student teachers. Many of these neophyte elementary teachers fail to share the enthusiasm for science that we expect of them and, based on their performances in other areas, we may well be incorrect in labelling them unmotivated. What, in fact, may be inappropriate is the conceptualization we apply in describing this problem. Rather than thinking about motivating these students, we might well consider another way of conceptualizing the teaching-learning process. Instead of unmotivated, these students may be more accurately described as 'disinvited'.

The concept of 'Invitational Education', based on Inviting School Success (Purkey, 1978), offers a fresh approach to the age-old problem of student motivation. Instead of thinking in terms such as 'motivate', 'modify', 'manipulate' or 'turn-on', this approach emphasizes the process of 'inviting' students to succeed. The word invite comes from the Latin word 'invito' which means "to summon cordially, not to shun". When used in the context of pre-service science education, it means that student teachers are responsible for messages they transmit to students formally or informally, verbally or non-verbally and take special effort and care to extend to students messages which cordially summon them to meaningfully sort out the world of science. While there is a recognition of the responsibility of the teacher in sending messages, there is also respect for the right of the student to respond to the invitation. For the science teacher Invitational Education provides both a new conceptualization for the teaching-learning process and a practical strategy for applying this plan of action.

In accepting the invitation to write this paper I am acting on the felt need expressed by Purkey to more fully operationalize what is meant by the invitational teacher in a particular context, namely the teaching of science. The paper explores invitational education as a useful plan of action which is seen to have heuristic value for both pre-service and in-service science education and identifies ramifications of this approach for the professional development of teachers.

The paper is set out in three sections. The first presents a brief overview and description of the model of invitational teaching with particular reference to relevant aspects to the classroom science teacher. The second section of the paper examines the possible relationship between the model of invitational education and postulated stages in the professional development of teachers. Questions in this area center around which stage reflects the highest degree of invitational teaching, how to maximize invitations within each stage of development. More specifically, it provides a general strategy that science teachers may employ to better invite students to meaningfully participate in the world of science. The final section of the paper profiles the inviting science teacher based on the development of pertinent skills inherent in the proposed model.

Invitational Education

Purkey's 1978 work Inviting School Success is an outgrowth of his earlier book (Self-Concept and School Achievement, 1970) which explored various dimensions of self-concept and their relationship to school achievement. Accepting the important role of self-concept in school achievement, the latter work directs its attention to how one may make, build or enhance students' self-concept within a school setting. The answer, according to Purkey, is to view the teacher as 'inviter'.

As used by Purkey,

> An 'invitation' is a summary description of messages - verbal and nonverbal, formal and informal - continuously transmitted to students with the intention of informing them that they are responsible, able and valuable. (Purkey, 1978, p. 3)

A 'disinvitation' on the other hand, conveys the opposite message to students - that they are irresponsible, incapable and worthless. These reciprocal concepts, 'invitations' and 'disinvitations' are at the heart of Purkey's model of invitational education and hold special meaning.

While the work on invitational education to date has been largely content-free, the model is seen to have considerable potential in specific subject areas. For example, in a science context it represents an approach consistent with the underlying philosophy of The Science Curriculum Improvement Study (SCIS) and its approach to the teaching of science. The definition of 'scientific literacy' offered by Karplus (1968) would appear to assume many of the characteristics of the inviting science teacher. To be scientifically literate is to functionally understand science in highly personal terms. The S.C.I.S. program is designed to have students experience science - as information gathered by a person, conceptualized by a person and explained by a person. The result, it is hoped, is a student who views himself or herself as someone who is capable of continuing to have similar personal encounters and to function conceptually and intellectually from his or her own experience base. Of particular interest to Purkey would be the types of messages used by science teachers "that bid students to see themselves as valuable, responsible, and capable of learning to behave accordingly" (Purkey, 1978). The science student who has been effectively invited to see himself or herself as able, valuable and responsible will undoubtedly possess these important attributes that contribute to what Karplus refers to as 'scientific literacy'. Science teachers should be particularly cognizant of the types of message they send to students and others regarding the worth and meaningfulness of

who they are and how they are doing. Those students continually being 'disinvited' in science will come to view themselves as incapable and inferior and stand little chance of success in the science domain. Past science disinvitations may be a major factor for the unhealthy attitude towards science teaching encountered in pre-service education.

According to Purkey (1978) the capacity to invite or disinvite always resides with the teacher and in many ways his work is an elaboration on the teacher's ability to intentionally or unintentionally exercise this 'inviting power' in a myriad of instances. Before relating this aspect to science education, it is necessary to identify the levels of invitational teaching proposed by Purkey. He identifies four:

Level 1. Intentionally disinviting,

Level 2. Unintentionally disinviting,

Level 3. Unintentionally inviting,

Level 4. Intentionally inviting.

Teachers normally function at one of these four apparent levels from time to time. He further suggests that "most teachers appear to function typically at one level more than others" (p. 17). While no empirical evidence is provided to support this contention, the invitational levels identified are seen to have considerable implication for the classroom science teacher.

Level 1. Intentionally Disinviting

It is difficult to conceive of science teachers operating at this level for any significant portion of their time, yet instances do come to mind where students were clearly informed of their incapability, worthlessness and irresponsibility. In science this level unfortunately is reflected by statements like, 'some students should not be taking science' or 'you are not allowed to try . . .'. One can only hope that few teachers intentionally disinvite students in this manner.

Level 2. Unintentionally Disinviting

For those involved in pre-service education, this is a particularly interesting and often familiar level. Teachers and student teachers who unintentionally disinvite students are "usually well-meaning and high-minded, but their teaching methods belie their good intentions" (p. 18). Science teaching at this level is usually characterized by massive amounts of worksheets, busy work and a certain insensitivity and unawareness of the students' feelings. Disinvitations of this type, in science, occur when girls are infrequently chosen to participate in a science demonstration, a student is permitted to try a dissection . . . if he or she really wants to, etc. Many instances of this level are related to the teacher's inability to take advantage of the so-called 'teachable moment'. Failure to recognize the power of such classroom instances often result in disinviting students unintentionally. An illustration of this was provided by a student teacher's structured lesson on winter adaptation by certain animals. Midway through the period an anxious student related once having seen a small mouse-like animal appear out of the deep snow and burrow back in again. All advantage of this potentially-inviting incident was lost when the student teacher responded that this was simply not possible.

Any teacher behaviour which students perceive to be chauvinistic, condescending or patronizing is likely to be interpreted as disinviting by the students, regardless of the teacher's intentionality. Presentation of material in science at an inappropriate level of sophistication given the developmental level of students involved would also follow within this level. Awareness of unintentional disinviting behaviour is of particular importance to the beginning science teacher, if he or she is to avoid the pitfalls of this level.

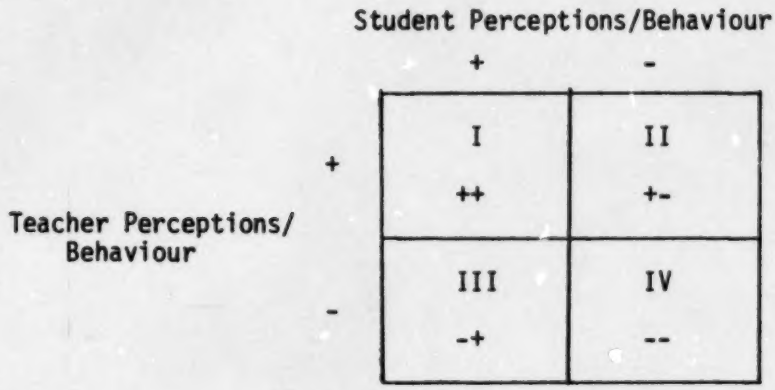
Level 3. Unintentionally Inviting

Unintentional invitations in science often occur spontaneously and arise without the teacher being able to identify precisely why the behaviour used was so successful. It is as if the teacher is able to invite learning effectively without an accurate awareness of the dynamics involved in the process. Witness the student teacher in science involved in the judging of a local school science fair. In an effort to better examine a student's exhibit, situated on the gymnasium floor, he decided to sit down. His action was followed immediately by the student joining him on the floor to willingly explain his project. There are undoubtedly a number of more subtle ways in which a teacher's behaviour results in students' feelings of being invited. However, until one can identify these means, he will be unable to intentionally invite success in science.

Level 4. Intentionally Inviting

There are a variety of ways and means available to science teachers to intentionally invite student participation in the world of science. This paper takes the position that science teachers should try to be explicit about the invitations they send to students. According to Purkey, "the more explicit an invitation, the more it lends itself to evaluation, direction, and modification" (p. 19).

In an extension of Purkey's work, Novak (1978) relates invitational teaching as a theory of interpersonal communication, emphasizing the self, the self system and the processes by which the self is created, maintained and enhanced. He views the direction of the invitational/disinvitational process negatively or positively depending upon the nature of student and teacher perceptions involved. At least four situations can arise as illustrated by the matrix:



The goal of invitational teaching, according to Novak, is to constantly strive to achieve the situation illustrated in Square I, where teachers who possess positive perceptions towards students interact with students who feel good about themselves. The latter section of this paper presents four areas which may prove useful to science teachers in achieving this end.

Developmental Sequence of Teacher Professional Growth

This section presents a developmental sequence for teacher professional growth in relation to Purkey's levels of invitational teaching. The postulated stages of professional growth based on Fuller's (1969) findings on the concerns of student teachers and later extended to beginning and experienced teachers (Kass and Wheeler, 1975), are characterized by a specific area of concern as the primary focus of the teacher's attention in his assessment of his own effectiveness. As noted by Keavney and Sinclair (1978), Fuller's conceptualization does not show that concerns decrease, only that they change their nature (self to task to pupil). As presented in this section, the postulated change in focus of concern among teachers may be better explained by the actual operating level of invitational teaching associated with each stage of growth.

The stages of teacher professional growth (Kass and Wheeler, 1975) are sequential, with each stage involving specific types of classroom behaviour.

Stage I - concern over self
(teacher-centered period)

Stage II - concern over instructional matters
(content-structure period)

Stage III - concern over individual learning problems
(student-centered period)

Resolution of earlier stage concerns is hypothesized as leading to the later stage concerns and previous stage competencies are subsumed in the characteristic teaching behaviour at the next stage. Individual teachers may move through the developmental sequence at different rates, or remain at either the first or second stage throughout their teaching careers.

Stage I - Teacher-Centered Period

Stage I concerns can be broadly classified as concerns over "self" and refers to those attitudes and feelings the teacher holds about himself and his role and their influence on his teaching behaviour. It includes concerns over class control and discipline, content competency, and evaluation of the novice teacher by others. Most concerns in this initial stage of teaching are perceived to involve assessments of the teacher's adequacy by himself, his students, his colleagues, and others. This generalized concern over adequacy involves the ability to master the curriculum, to know the answers to student questions, to say "I don't know" on occasion, to become familiar with the available resources and equipment, to get the class to do what is intended, to anticipate problems -- in other words, to "survive" in the classroom. It also involves the establishment of working relationships with school personnel and with gaining acceptance as a professional within the social organization of the school. Taken together, such matters form a massive concern of beginning teachers (York, 1968).

Stage II - Concern Over Instructional Matters
(Content-Structure Centered Period)

Major concerns in this stage of development center on the teaching environment, instructional strategies and the structure of the discipline

and of the curriculum. Teacher emphasis is placed on what has been termed the intellectual grasp or cognitive organization of what is to be taught. Although Stage II teaching represents a shift away from the more obvious "self-oriented" concerns of Stage I, teaching is still primarily directed towards the class as a unit with relatively lesser consideration placed upon individual learning problems. The emphasis is clearly on teaching and teaching efficiently. However, there is a willingness to experiment, to try various instructional approaches, and to be less text-oriented than in the initial stage.

Stage III - Concern Over Individual Learning Problems (Student Centered Period)

Stage III concerns clearly center on the student, with conscious effort on the part of the teacher to understand individual student capabilities in learning, to assess individual performance, and to separate his contribution to the student's successes and failures from those of the student. Evaluation is viewed in terms of the student's gain in relation to his own potential.

The Stage III teacher is fully cognizant to both the differential effects of various educational approaches and the differential consequences of measuring educational achievement. Major concerns of this stage focus on the student: his specific learning problems, his growth problems, and his behaviour problems. The Stage III teacher is also conscious of the problems that involve subtle or little understood aspects of pedagogical behaviour, namely, the teacher's expectations of student performance and the resulting cues or individualization. At what point Stage II concerns are superseded by Stage III priorities, as the focus of conscious attention and concern on the part of the teacher, is open to investigation. It is unlikely that some teachers attain this stage consistently.

Table I outlines a proposed correspondence between the postulated concern-based stages of teacher growth and Purkey's levels of invitational teaching.

TABLE I

Stages of Professional Growth vs.
Levels of Invitational Teaching

Concern-based sequence	Levels of invitational teaching
(no correlate)	Level I - Intentionally Disinviting
Stage I - Teacher-Centered Period	Level 2 - Unintentionally Disinviting
Stage II - Content-Structure Period	Level 3 - Unintentionally Inviting
Stage III - Student-Centered Period	Level 4 - Intentionally Inviting

The invitational level indicated opposite each growth stage represents only that level most likely to occur given the pattern of teacher behaviour associated with each stage. While the intentionally disinviting teacher (Level I) has no analogue in the proposed sequence of development, intentional invitational teaching (Level 4) is clearly seen in relation to Stage III attributes. Hence the levels of invitational teaching are in general agreement with the direction of sound professional growth.

Stage I is characterized by a high degree of teacher directiveness and domination and hence possesses the highest probability for disinviting teacher to occur. Further, Stage I is seen as a period of considerable stress which may result from what Merrill and Jex (1964) have termed the teacher's role conflict. On one hand the teacher is rewarded by the educational community if he is competitive, authoritarian, content-oriented, discipline-oriented,

achievement-oriented and generally demanding of a high degree of performance of his students. On the other hand, he is rewarded if he is non-competitive, supportive, conforming, and takes responsibility by helping and guiding the students. The Stage I teacher is prone to the former position and the extent to which he is able to be other-oriented depends upon his ability to resolve these early major concerns. Often this is accomplished at the expense of a high degree of Level 2 (unintentionally disinviting) teaching.

The growing body of research in education associated with self-concept theory (Combs, Avila, and Purkey, 1971, 1978; Rogers, 1951, 1967) emphasizes the importance of the teacher's self-concept in determining teacher behaviour. Lantz (1964) showed the importance of the student teachers' self-concept on their behaviour. Changes in self-concept during student teaching do occur, but they occur slowly and in a non-threatening environment. For this reason, Stage I is viewed as a critical period for determining future professional growth toward the later student-centered period. Until the teacher feels adequate and secure himself, he is not likely to help students feel secure.

It may be that the intentionally disinviting teacher (Level I) has adopted this disinviting approach as a form of coping style in an attempt to reduce anxiety. As noted by Sinclair et al. (1974), while coping styles are implemented to reduce anxiety, their impact need not necessarily be totally positive. One possible style, dogmatism, for example, may be less conducive to the learning process than the anxiety it replaces. In a similar manner the intentionally disinviting behaviour indicative of Level I may represent an equally undesirable coping strategy.

At Stage II the structure of the subject matter frequently serves as the theoretical framework for teaching. Questions of concept organization, objectives, methods of presentation, the design of effective instructional materials and activities and related considerations directed at developing

effective teaching approaches to the topic are the focus of attention. The manifestations of such concerns by the Stage II teacher are reflected in his attempts in classroom curricular innovation, experimentation with rearrangement and sequencing of topics within his discipline and the increasing flexibility of approach exhibited in his teaching.

Much of the teaching at this stage proves successful although the Stage II teacher is often unaware of the dynamics involved in the process. The unintentionally inviting teacher is often not in a position to identify the causes of his or her successes or failures. Hopefully the Stage II teacher begins to identify what makes a difference in his behaviour and begins to intentionally invite success in his classroom.

One important dimension of the Stage III teacher pertains to the degree to which he permits students to discover underlying concepts and generalizations for themselves. The Stage III teacher realizes that it is not always desirable merely to tell the student what you want him to know and understand. Rather, it is sometimes better to ask questions, to invite the student to become active, to seek for himself, and to use and evaluate his own ideas. The Stage III teacher intentionally invites success in his classroom without abandoning the student entirely to his own devices. Invitational teaching at this level is closely related to what Gage (1968) has termed 'indirectiveness'.

Relationships among professed concerns, teaching behaviour and Purkey's levels of invitational teaching warrant examination both within and across the stages. Invitational education viewed in conjunction with stages of professional concern might prove useful as a variable in reconciling some of the conflicting results in teacher effectiveness research. For purposes of this paper, it is seen to provide a general strategy that science teachers may employ to better invite more meaningful participation in the world of science.

The 'Inviting' Science Teacher

This section outlines pertinent skills possessed by the effectively inviting science teacher in relation to the proposed model developed in the previous section. Four general areas are presented which are central to the development of invitational education in a science context.

All four (inviting success, openness, action, and sharing), convey intentionality on the part of the science teacher to promote greater student success in science and are closely associated with Stage III characteristics presented earlier.

Inviting success

Success is normally defined in terms of a favourable termination or conclusion of some undertaking. While accepting this definition for inviting successful science teaching, often it is not realized for two main reasons: (i) unrealistic (and sometimes inaccurate) expectations for the student and (ii) inadequate student involvement in the process. How often have students been 'turned-off' by elaborate, unrealistic, sophisticated experimentation in the name of science teaching? Here success was considered only in terms of one's ability to duplicate the 'correct' answer within a certain error tolerance, or by carefully following a rigid structure and sequence. Any sense of student excitement or accomplishment under these conditions was short-lived. Clearly any and all invitations to explore science with students should contain every reasonable chance of success if acted upon. While not dismissing success in elaborate experimentation referred to above, this has to be preceded by and built upon by a sound foundation of earlier successes. At the elementary level this may simply mean a successful resolution to questions, like "how can you make the compass needle move by using a magnet?" or "what happens when snow is brought indoors?"

Inadequate student participation and involvement is a second factor limiting successful science teaching. To begin to develop a sense of success in science, the student must feel that he or she is the one who is successful, not the teacher. Too much teacher talk and teacher directiveness (characteristics of Stage I teaching) favour the occurrence of unintentional disinvitations in science. Inviting participation in chosen areas in science is a powerful 'jumping-off point' for students' successful exploration of their environment.

Inviting openness

Openness refers to that quality of science which always permits further consideration of the question, a willingness to examine and analyze publicly what has been revealed through investigation. To invite openness in the science classroom is to be able to be adaptable to the developing needs and interests of the students. The extent of openness one invites in the science classroom is directly related to the degree to which one includes the desires and interests of students in planning all attributes of Stage III teaching.

The invitational science teacher actively encourages speculation, guessing and student attempts at problem solving. Asking provocative, open-ended questions in science serves to invite student openness in science. Rowe's (1974) work with wait-time with science teachers revealed that often silence can be more inviting than words. Her research suggests that as teachers increase their wait-time to three seconds or longer, a number of student variables change in a direction that makes for better inquiry in science. According to Rowe (1973), when teachers gain control of wait-time, questioning becomes less barrage-like and more flexible in time, reflecting a genuine interest in the ideas of students (p. 258).

Inviting action

The inviting science classroom is one designed to give the student many opportunities to interact with the "things" and "stuff" of science and to

interact with others in doing so. Sciencing always involves some kind of personal action, physical or mental. This sense of action extends beyond the normal classroom involvement in activities, even to displays in the science classroom which should maximize this component. For example, an aquarium with fish is nice, but one which includes a question to ponder is more intriguing and inviting! (e.g. What is the green stuff on the glass?)

A static display of a working electrical circuit that can be switched on or off is good, but having the ncessary materials available to students to make their own circuits is better. By always taking that extra step in inviting a greater degree of action, it is possible to increase this component significantly.

Inviting sharing

Sharing refers to those opportunities provided by the teacher for the student to communicate his or her personal involvement with science. It is important, for example, to allow students to "science" in front of the entire class, do a demonstration or experiment, tell about a nature walk, or to share other science related experiences. To do this they must be made to feel secure enough to want to share their experiences. Hopefully, these may also involve their misconceptions in science and unsuccessful ventures. To invite this to happen may require that the teacher also has to begin to disclose his or her "human failings"! Once achieved some of the most successful "sciencing" will be accomplished during these sharing sessions. Sharing can be a powerful tool providing students with a chance for leadership experience. The science classroom is an ideal setting to gain this experience.

Whether inviting success, openness, action or sharing, invitations represent a means to cordially summon students to do something challenging and meaningful. Invitations in science can make a difference.

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